ORIGINAL ARTICLE

Early Postoperative Complications Following Myelomeningocele Repair

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ABSTRACT

Introduction: *Neural tube defects are one of the most common congenital anomalies which frequently needs operative intervention for the anomaly correction. Complications can arise in these paediatric patients peri-operatively which require special considerations.*

Materials and Methods: *After taking informed consent patient data was gathered in pre-designed pro-forma. After MMC repair patients were followed till the time of discharge and up to 1 month afterwards and record made of any early postoperative complications. Data was gathered about patient demographics along with postoperative recovery variables. Analysis of the data was done using SPSS version 20.0. Data was presented using graphs, charts and figures.*

Results: *197 patients were included in the study with 54.31% males and 45.69% females with mean age of 71.4 days ± 61.9 SD. 68.5% patients developed at least some form of complication. The most common postoperative complication was hydrocephalous (57.4%) which was followed by postoperative fever (27.4%). VP shunt was inserted in 50.3% patients. There was no significant association between age or gender to the occurrence of complications (p = 0.85 and 0.47 respectively).*

Conclusion: *Since majority of infants die within the early postoperative period we should be vigilant regarding developments of these complications and minimising them. By documenting the early postoperative complications, the surgical teams can improve their outcome.*

Keywords: *Neural tube defects, Myelomeningocele, Spina bifida, postoperative complications.*

INTRODUCTION

Human disabilities are one of the leading burden of disease upon our society. According to the 'World Report on Disability', there are more than one billion persons with a variety of disabilities which amounts to above 15% of the world population.[1]

Neural tube defects are one of the most common congenital birth defects resulting in a significant number of physical, mental and social disabilities in the earlier years of life. The incidence of these anomalies is very high in the developing world, while in the western countries it has reached a steady state where no decrease is noted despite significant research into its prevention.[2-4]

These anomalies are the most debilitating amongst all the structural malformations and have a grave impact upon the functioning of individuals, families and communities as a consequence.[5,6] Among the affected are the families from lower socio-economic status and especially those with poor food quality and hygiene.[7]

Amongst the central nervous system anomalies which are reported in 31% of newborns with anomalies, myelomeningocele (MMC) is the most common of the central nervous system defects with upto 71% occurrence.[8] The incidence is reported to range from 3 to 6 per 1000 live births[8,9] **(Figure 1: Upper Dorsal Myelomeningocele).**

The current surgical guidelines advise for early repair of the myelomeningocele defect, within 48 hours, and to shunt the hydrocephalus at right time if

Figure 1: *Upper Dorsal Myelomeningocele.*

present concomitantly. Typically, the myelomeningocele defect is repaired within 24 to 48 hours of birth and the infant is followed closely for development of signs of hydrocephalus. In more than 70% of infants however, hydrocephalus develops early post-operatively and ultimately require shunting of CSF. Among the remaining patients, hydrocephalus may develop later at any time in life.[10]

A study into short term outcome of surgical management of patients with spina bifida by Khan et al reported various complications. Almost all patients experienced postoperative pyrexia, wound infection was estimated at 9%, 30% cases of cerebrospinal fluid (CSF) leakage through the wound and 21.2% of patients developed hydrocephalous. The mortality in this study was reported to be 17%.[10]

The above mentioned studies show that there are wide differences in terms of early post-operative outcome in patients who are operated for myelomeningocele. These differences are presented by both international studies as well domestic literature. Some studies, for instance, have shown no mortality in early post-operative period of these patients while others have documented a mortality of up to 20%. All of these studies, however were focussed in terms of overall outcome and not specifically over the development or management of post-operative complications. Such wide variations could be investigated by repeat studies which are specifically focussed on the development of early post-operative complications.

OBJECTIVE

The main objective of this study was;

To study the frequencies of common early post-operative complications in patients of myelomeningocele repair.

MATERIAL AND METHODS

Study Design: Descriptive case series.

Sampling Methods: Non-probability consecutive sampling method.

Setting: The study was conducted in the Department of Neurosurgery, Hayatabad Medical Complex Peshawar.

Duration: The study duration was 12 months from March 2014 to March 2015.

Inclusion Criteria: The following patients were included in the study;

1. Patients of both genders.
2. Patients between birth and six months of age.
3. Patients with the diagnosis of myelomeningocele.
4. Patients with a defect size of 10 cm in diameter or less.

Exclusion Criteria: All the following patients were excluded;

1. Patients with other forms of spina bifida such as encephalocoele and variants of spina bifida occulta.
2. Patients with elsewhere operated myelomeningocele.
3. Patients with advanced hydrocephalous concomitant with myelomeningocele.
4. Moribund patients who are not fit for general anaesthesia or surgery.

Data Collection Procedure

All patients with Myelomeningocele admitted in Neurosurgery department of Hayatabad Medical Complex, selected randomly through Outpatient Department (OPD), Emergency and Calls from other units of Hayatabad Medical Complex Peshawar were approached. Only those patients who fulfil the inclusion criteria were included in the study. Data was collected on a predesigned pro forma. This pro forma included information about the identity of patient like name, age, gender, address, admission number, mode of admission, location of the Myelomeningocele, size of the Myelomeningocele, time of presentation and associated anomalies.

Diagnosis of Myelomeningocele was made on clinical examination. Decision regarding operative/con-

servative treatment was made by a Consultant Neurosurgeon. Patients were operated under general anaesthesia by a Consultant Neurosurgeon. Patients were followed post-operatively till discharge from the hospital and up to one month thereafter. The patients wereassessed by a Neurosurgeon for development of any complications and they were treated accordingly. Observation and examination were recorded on predesigned pro-forma. To control confounders and bias in the study results, exclusion criteria was followed strictly.

Data Analysis Procedure

Statistical Package for Social Sciences (SPSS version 20) was used to enter and analyse the data. Descriptive statistics like mean and standard deviations were calculated for quantitative variables like age. Frequency/percentage were calculated for categorical variables like gender and postoperative complications (fever, wound infection, wound dehiscence, CSF leak, and hydrocephalous). Postoperative complications were stratified among age and gender to the effects of modifiers. Post stratification was done through chi square test keeping p-value less than or equal to 0.05. All results were presented in the form of charts and graphs.

RESULTS

In this study we included a total of 197 patients with 107 (54.3%) males and 90 (45.7%) females in a male to female ratio of 1.46:1. In this study the mean age was 71.4 days ± 61.75 SD **(Table 1: Descriptive Statistics).** Age distribution and the various age groups composition are summarised in **(Figure 2: Age Group Distribution).**

The geographical areas to where patients belonged are presented in **(Figure 2: Region Wise Distribution).** The majority i.e. 42 (21.3%) patients belonged to various regions of Afghanistan, followed by Dir (n = 17, 8.6%), and Khyber Agency (n = 17, 8.6%).

The spinal level of the myelomeningocele (MMC) defects in descending order was Lumbar (n = 100, 50.8%), Lumbosacral (n = 26, 13.2%) Thoracolumbar (n = 26, 13.2%), Thoracic (n = 21, 10.7%), Sacral (n = 17, 8.6%) and Cervicothoracic region (n = 7, 3.6%) **(Table 2: Neurosegmental level of the defect).**

Size of the defect was measured in centimetres as the diameter of the base of the defect in the greatest axis. The mean size of the defect was 7.71 cm ± 2.63 SD. Our findings are listed below in **(Figure 3: Defect Size Distribution).**

Our main study outcome measure was the occurrence of early postoperative complications. Postoperative complications were noted during the stay in ward and one month after discharge from ward. The most common complication was the development of Hydrocephalous (n = 113, 57.4%) and about 50.3% (n = 99) patients received a shunt insertion during the study period. This was followed in order by fever (n = 54, 27.4%), wound infection (n = 23, 11.7%), meningitis (n = 22, 11.2%), CSF leak (n = 16, 8.1%), Sepsis (n = 16, 8.1%) and wound dehiscence which was noted in 9 (4.5%) patients **(Variable. The western and other more developed societies** have shown that is incidence could be decreased by simple preventive steps such as folate fortification, gentic counselling and prenatal care for the mothers.[12] It has been shown that good medical care of the newborns with spina bifida is the rightly needed modality which can help alleviate the suffering of the patient and sufficiently ease the discourse of the parents and relatives.[3] More recently, fetal surgery, good multidisciplinary care of the mother and the baby and long-term availability of professional health services can improve outcomes.[5,13-15] However, despite everything that could be done to treat the condition, it is wise to do to **Table 3: Postoperative Complications and their respective frequencies) and (Figure 5: Postoperative Complications and their Frequencies.**

We also recorded 41 (20.8%) cases in which the cyst of MMC was ruptured preoperatively.

The complications were stratified according to Gender and Age groups and their frequencies and percentages plotted as shown in (Error! Reference source not found), **(Figure 6: Complications to Gender Distribution)** respectively. Postoperative hydrocephalous was most common in all age groups which was followed in frequency by postoperative fever and wound infection. Wound dehiscence, CSF leak, meningitis and sepsis occurred in ten percent or less patients. Similar trend was observed when the complications were stratified according to gender of the patients. Chi square test for age groups versus postoperative hydrocephalous showed a statistically non-significant result (p = 0.42) while similar result was obtained between age groups versus VP shunt insertion (p = 0.21). Chi square test for gender versus postoperative hydrocephalous development showed a statistically significant result (p = 0.004) while shunt insertion versus gender was also statistically significant (p = 0.003).

Table 1: *Descriptive Statistics.*

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age in Days	196	2	300	71.43	61.909
Length of Stay	196	3	13	5.03	2.058
Defect Size in cm	196	4	15	7.69	2.641

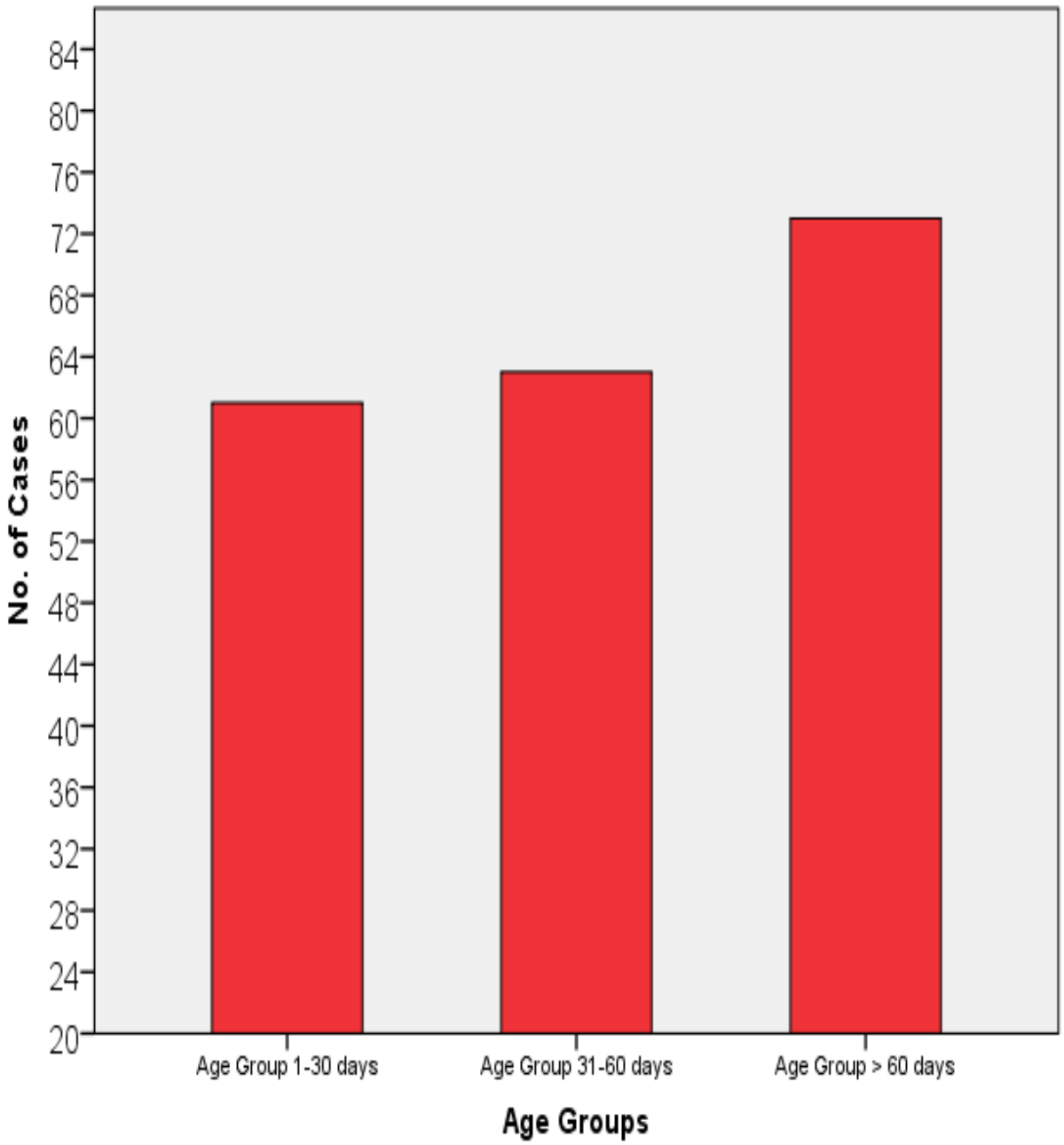

Figure 2: *Age Groups Distribution.*

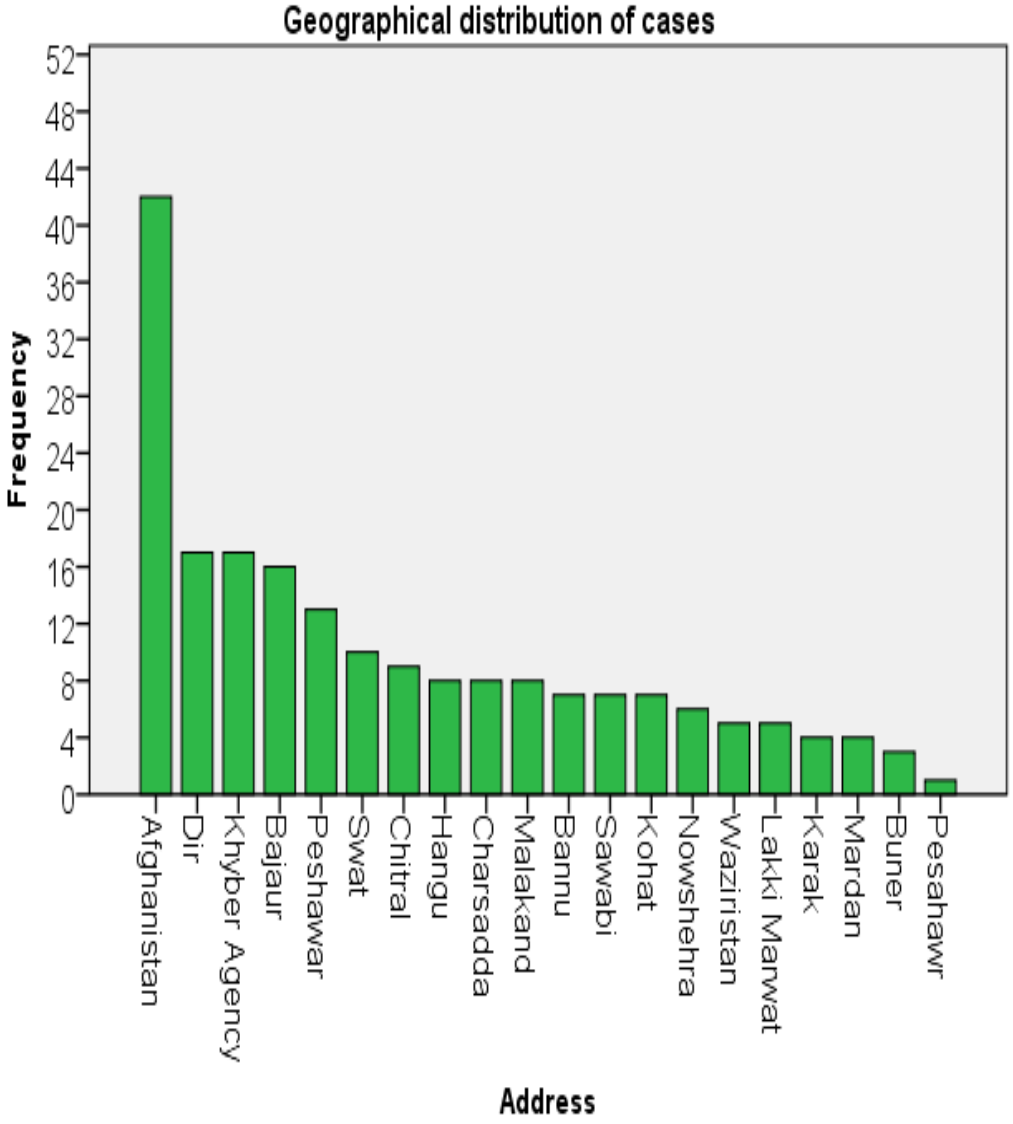

Figure 3: *Region Wise Distribution.*

Table 2: *Neurosegmental level of the defect.*

Spinal Level of the Defect	Frequency (n)	Percent (%)
CervicoThoracic	7	3.6%
Thoracic	21	10.7%
Thoracolumbar	26	13.2%
Lumbar	100	50.8%
Lumbosacral	26	13.2%
Sacral	17	8.6%
Total	197	100.0

Length of stay of the patients was detected using the date of admission and date of discharge. The mean length of stay was found to be 5.03 days ± 2.058. The longest stay was recorded 13 days for one (0.5%) patient. All patients were admitted for at least 3 or more days. The trend is shown in **(Figure 7: Length of Stay).**

During the follow up period no patients were lost to follow-up while 15.7% (n = 31) patients died. All patients died due to infective complicat-ions after repair of the defect.

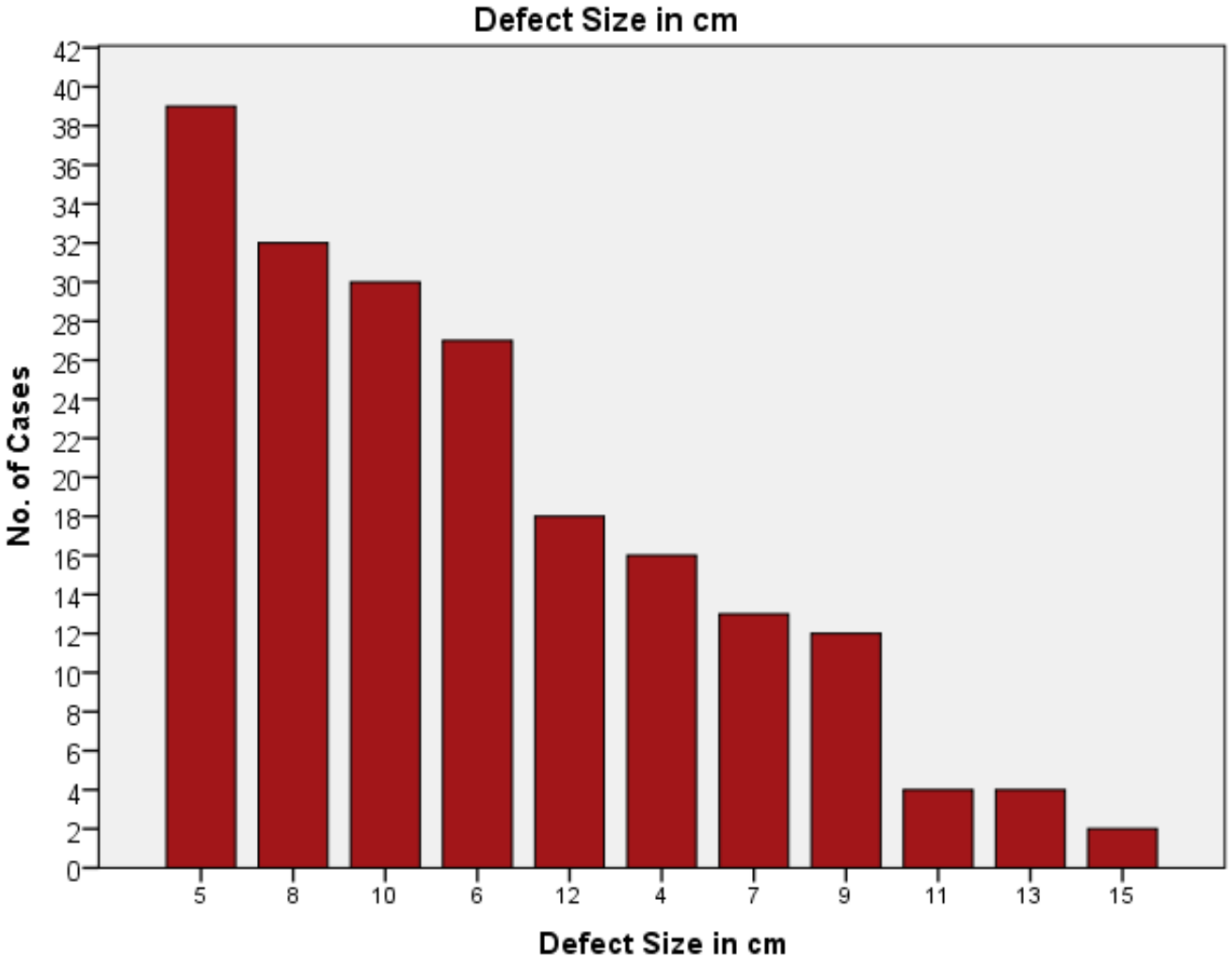

Figure 4: *Defect Size Distribution.*

DISCUSSION

Myelomeningocele also known as myelodysplasia or spina bifida cystica and spina bifida aperta is a devastating congenital disorder which has immense adverse impact on individuals, families and societies in the form of the associated disabilities and the burden of a lifelong disease entity that needs continuous care by health professionals as well as friends, families and community members.[11] The worldwide prevalence of neural tube defects as a whole and myelomeningocele specifically is quite variable. The western and other more developed societies have shown that its incidence could be decreased by simple

Table 3: *Postoperative Complications and their respective frequencies.*

Complications	Frequency (n)	Percentage (%)
Wound Infection	23	11.7%
Wound Dehiscence	9	4.5%
Postoperative Fever	54	27.4%
Postoperative CSF Leak	16	8.1%
Postoperative Sepsis	16	8.1%
Postoperative Meningitis	22	11.2%
Postoperative Hydrocephalous	113	57.4%
VP shunt insertion	99	50.3%
Preoperative Rupture of Cyst	41	20.8%

Figure 5: *Postoperative Complications and their Frequencies.*

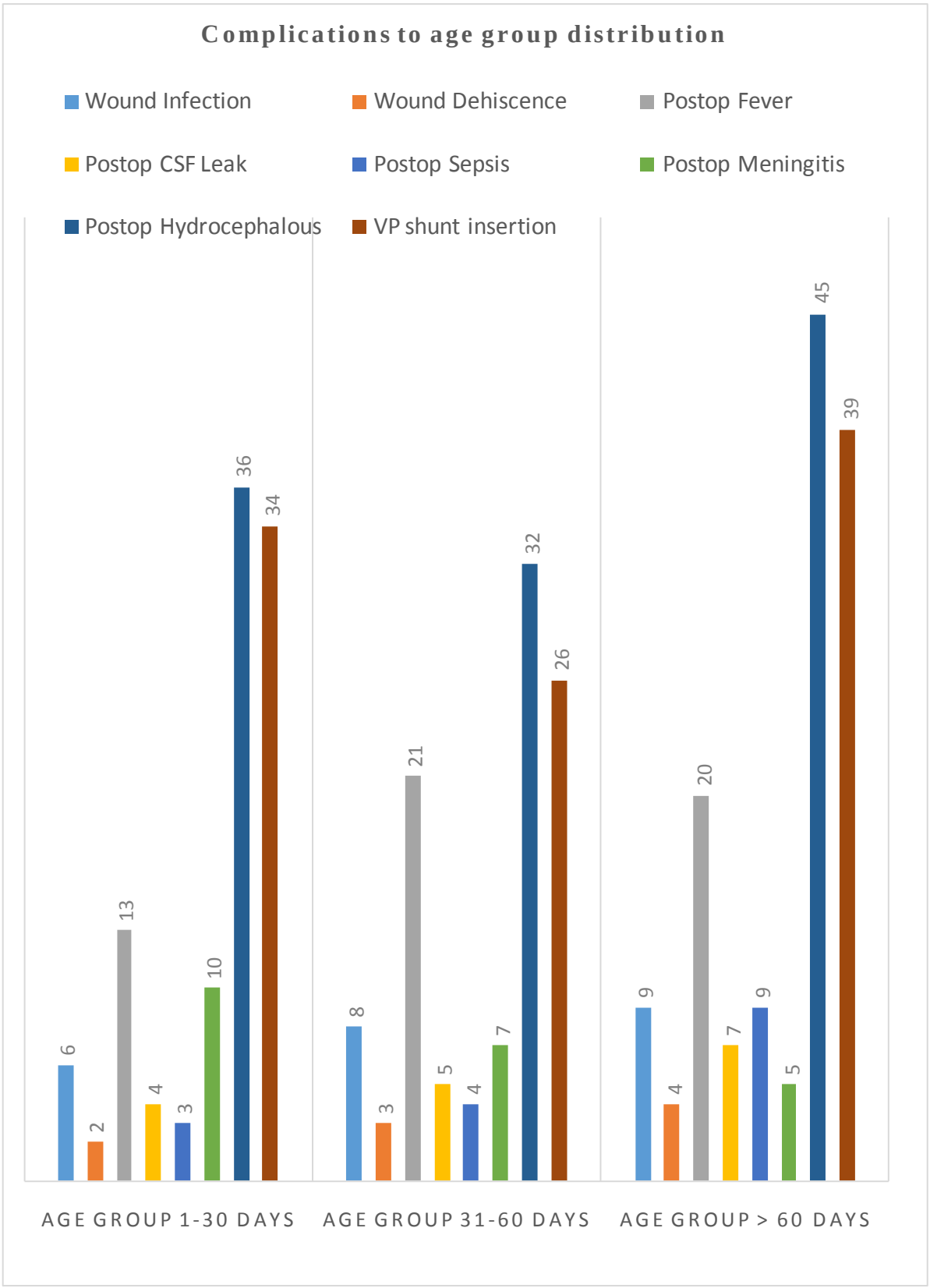

Figure 6: *Complications to Age Groups.*

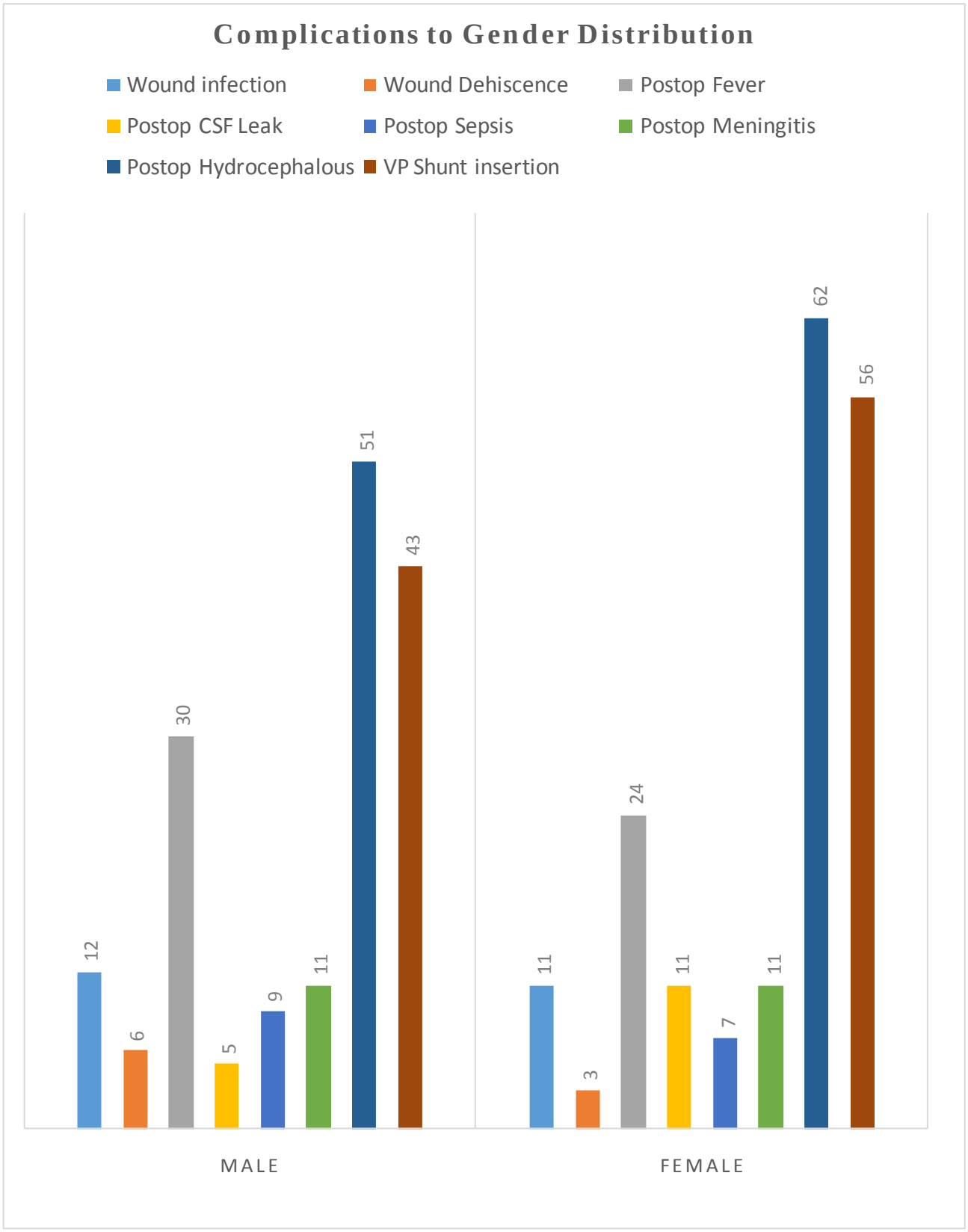

Figure 7: *Complications to Gender Distribution.*

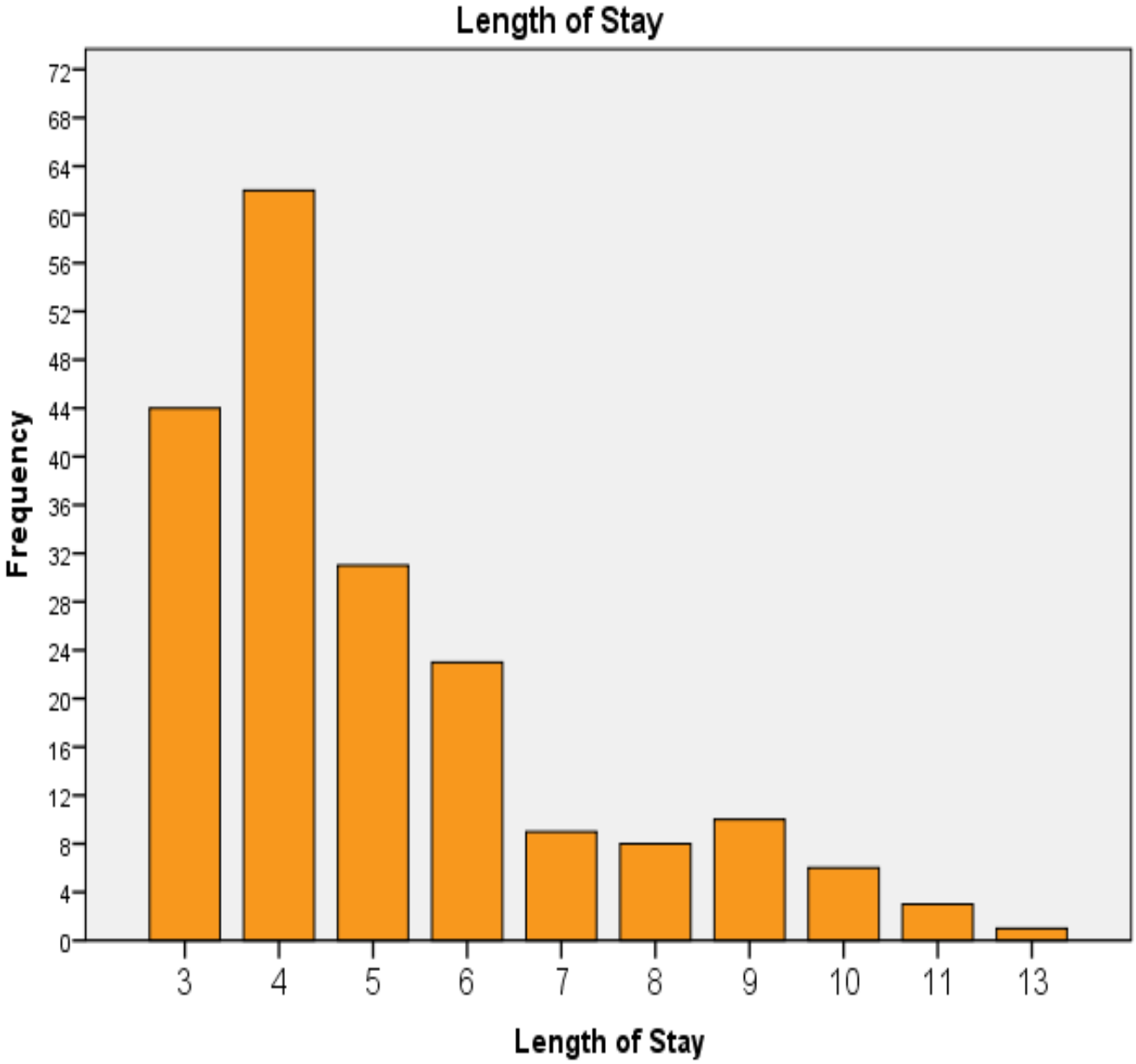

Figure 8: *Length of Stay.*

preventive steps such as folate fortification, genetic counselling and prenatal care for the mothers.[12] It has been shown that good medical care of the newborns with spina bifida is the rightly needed modality which can help alleviate the suffering of the patient and sufficiently ease the discourse of the parents and relatives.[3] More recently, fetal surgery, good multidisciplinary care of the mother and the baby and long-term availability of professional health services can improve outcomes.[5,13-15] However, despite everything that could be done to treat the condition, it is wise to do to prevent its occurrence by identifying the variables which impact its occurrence.

We conducted this study to elucidate the importance of good surgical care by identifying the emergence of any postoperative complications in the immediate period following repair of myelomeningocele.

In this study we included 197 patients of which 54.31% were males and 45.69% were females in a ratio of 1.46:1 with a mean age of 71.4 days ± 61.9

SD. These findings were in agreement with the studies by Idowu OE et al,[16] Aygun C et al,[17] Ali MZ et al,[18] and Brohi AR et al.[19] Idowu OE[16] and Aygun C et al,[17] reported an average time of repair at maximum two weeks after birth with good postoperative outcome in terms of wound infection. The older age at presentation in our study points out the lack of financial resources, far flung areas with scant transportation facilities and the parents belief in local treatments such as spiritual healing and possession by Jinn. Parents are also dejective regarding the surgical procedure upon their child due to the possibility of postoperative complications.

We noted that the average defect size was 7.69 cm ± 2.64 SD which is a moderate size for a myelomeningocele defect. Only rarely we took the help of a plastic surgeon in order to properly close the skin defect after repair. Study by Selcuk CT[20] have shown that the larger the defect, the difficult the closure technique and the higher the wound complications rate. However Aygun C et al,[17] has shown that size of the defect did not affect the occurrence of wound infection ($p = 0.35$).

In our study the most common defect site was lumbar and lumbosacral region with more than 63% cases which was followed by thoracolumbar (13.2%) and sacral regions (8.6%) **(Table 2: Neurosegmental level of the defect).** In contrast to our findings, a study by Ugwu RO et al,[21] has shown that the most common site was thoracolumbar in 93.5% patients, while Aygun C et al,[17] has shown that lumbosacral location was the most common (36%). Similarly Ali MH et al[22] recorded thoracolumbar area in 60% of their patients. Idris B[23] has determined the importance ($p < 0.001$) of the spinal segmental level of the myelomeningocele defect and stated that an intact L3 segmental level is predictive of good motor control in lower limbs. Other studies have also emphasized the neurosegmental level of the defect because the higher the level of the lesion the higher is the motor dysfunction in lower limbs and sphincters, the lower the chances of later ambulation.[10,23,24]

In this case series the most common complication was the development of hydrocephalous which occurred in 57.4% patients with 50.3% patients receiving CSF diversion procedures during the follow up period. This was followed in frequency by early postoperative pyrexia of more than 100°F in 27.4% patients. Wound infection occurred in 11.7% cases while 4.7% cases ultimately developed superficial wound dehiscence **(Figure 9: Wound Infection and Dehiscence after MMC Repair).**

Figure 9: *Wound Infection and Dehiscence after MMC Repair.*

These findings are concurrent with studies by Elgamal EA et al,[25] who has described 62% patients who required shunt postoperatively and a review article by Thompson DNP[26] who has agreed to the occurrence of postoperative hydrocephalous as the most common complication. Similarly studies by Aygun C et al,[17] has recorded 67% patients with postoperative hydrocephalous while Khan HU et al,[27] has described postoperative hydrocephalous occurring in 52.5% of their patients. Wound infection is reported to be in the range of 1 – 12% in the available literature which shows that our findings are concurrent. Ali MH et al,[22] has reported wound infection rate of 16% while Aygun C et al,[17] has described 21% of their patients developing wound infection and 17% developing necrosis and dehiscence.

As shown in **patient died due to infective complications after repair** of the defect.

DISCUSSION

Myelomeningocele also known as myelo-dysplasia or spina fifida cystic and spina difida aperta is a devastating congenital disorder which has immense adverse impace in individuals, families and societies in the form of the associated disabilities and the burden of a lifelong disease entity that needs continuous care by health professionals as well as friends, families and community members.[11] The worldwide prevalence of neural tube defects as a whole and myelomeningocele specifically **Table 3** Postoperative Complications and their respective frequencies we recorded CSF leaks and sepsis in 8.1% of patients for each, while 11.2% patients developed postoperative meningitis or ventriculitis. Khan HU et al,[27] has described a CSF leak of 7.5% while Hashim ASM et al,[28] has described a 5.3%

CSF leak postoperatively. Aygun C et al[17] has descrybed 17% cases who developed septicaemia after repair. In contrast to our findings a study by Ali MH et al,[22] has described a CSF leak rate of 16% which is quite high. Schroeder HK et al,[29] in their multivariate case series described sepsis in 3.3% patients which was highly associated with the topography of the myelomeningocele defect and the ventricular Evan's ratio (adjusted OR 10.5; CI 95% 1.6 – 67.4; p = 0.01). According to a large study by Rakei S et al,[30] CSF leaks were present in 21% of their patients and meningitis occurred in 18% of patients leading to a mortality of 3%.

Stratification of the complications according to age and gender and the application of Chi square test to determine any association to the outcome in the form of significant complications or death was performed. The test did not show any statistical significance for either age or gender group **(p = 0.85 and 0.47 respectively)**.

In this study we recorded a mortality of 15.7% (n = 31) which is slightly higher than the one reported by Hashim ASM et al[28] (1.3%) and Aygun C et al,[17] (7%) while it is similar to the mortality reported by Khan MY et al,[10] (17.7%). The reason for a high mortality could be late presentation when hydrocephalous, ventriculitis and meningitis has taken over and also the poor modes of referral system in far flung areas where experience with cases of central nervous system malformations and hydrocephalous is scant. This could be improved by good public health outreach facilities and pro-active neurosurgical care. Good advice to the parents about care at home and educating them about the signs of increased intracranial pressure or meningitis can also save lives in cases who are lost due to shunt malfunction, hydrocephalous development or meningitis and septicaemia.

These trends of the early postoperative complications highlight that hydrocephalous is the most common occurring in more than half of the operated patients. Due to the higher cognitive impact of the ventricular dilatation caused by hydrocephalous and high intracranial pressure a good clinical acumen is needed to identify those who are in need of a CSF diversion procedure. Moreover, higher incidence of postoperative pyrexia and its benign nature has pointed out that it needs to be treated conservatively and only a minority of patients develop serious wound infections. Fatal septicaemia, generalised pyogenic meningitis and ventriculitis are the more fearsome complications which appear early in the course of the postoperative period and their early and aggressive treatment could be translated into good surgical outcome.

The limitations of our study are the low sample size, the short duration of follow up of only one month and poor hospital – parent communication. Long term follow-up is required and complications arising during the course of few years have to be recorded and managed promptly. It is also to be emphasized that early neurosurgical intervention for repair of the defect, good anaesthesia care and intensive care availability can improve outcomes.

CONCLUSION

Myelomeningocoele is one of the worst cases of central nervous system malformations which about half of the cases could be prevented by simple steps like folate supplementation, antenatal and perinatal obstetric screening and education of the parents about the benefits of early intervention. Since majority of infants die within the early postoperative period we should be vigilant regarding developments of these complications and minimising them. By documenting the early postoperative complications, the surgical teams can improve their outcome by correcting the management deficiencies and establishing a system for early identification and prompt treatment of the arising complications in this delicate period.

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